
Space Weather Technical Forecast

Issued on Saturday, 08 July 2023 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of R1/R2 radio blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with only minor C-class flares observed in the past 24 hours, with a peak of C4.2 at 07/0144 UTC. There are nine sunspot regions on the visible disc, with one currently unnumbered in the northwest quadrant. AR3363 is the largest region on the visible disc in the southeast, although appears to be stable. Meanwhile, AR3361 is the most magnetically complex and is currently classified as a Eai/Beta-Gamma-Delta configuration, with a delta spot contained within its trailing spot. No Earth-directed CMEs observed in available imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind as observed at L1, was predominantly at slightly elevated levels, and on occasion reached elevated levels, with a peak of around 520km/s observed at 07/1913UTC, before declining to around 410km/s at present. Total magnetic field strength was at moderate levels to start, around 8 nT, declining steadily to current weak levels of around 6nT. The north-south component (Bz) was weakly negative to start the period, around -7 nT, before increasing to become neutral to positive by the end of the period. The phi angle varied between positive (towards the Sun) and negative (away from the Sun) for much of the period. Geomagnetic activity has been largely Quiet to Unsettled (Kp 0-3), with an Active (Kp4) interval observed at 07/2100-0000 UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as observed by GOES16, was at background levels. High energy electron flux (greater than 2MeV), as observed by GOES16, was at background to moderate levels, with a peak around 650 pfu at 07/1435 UTC. The 24-hour integrated fluence was below the Active (1e8 integrated pfu) threshold and steady. A fluence of 1.28e7 pfu was recorded at 08/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: A continuation of generally Low to Moderate activity is expected through the period, with a slight chance of an isolated X-class flare. No major active region forecast to depart the visible disc during the period and far side sounding data suggesting further regions may rotate onto the disc into days 3 and 4 (10-11 July).

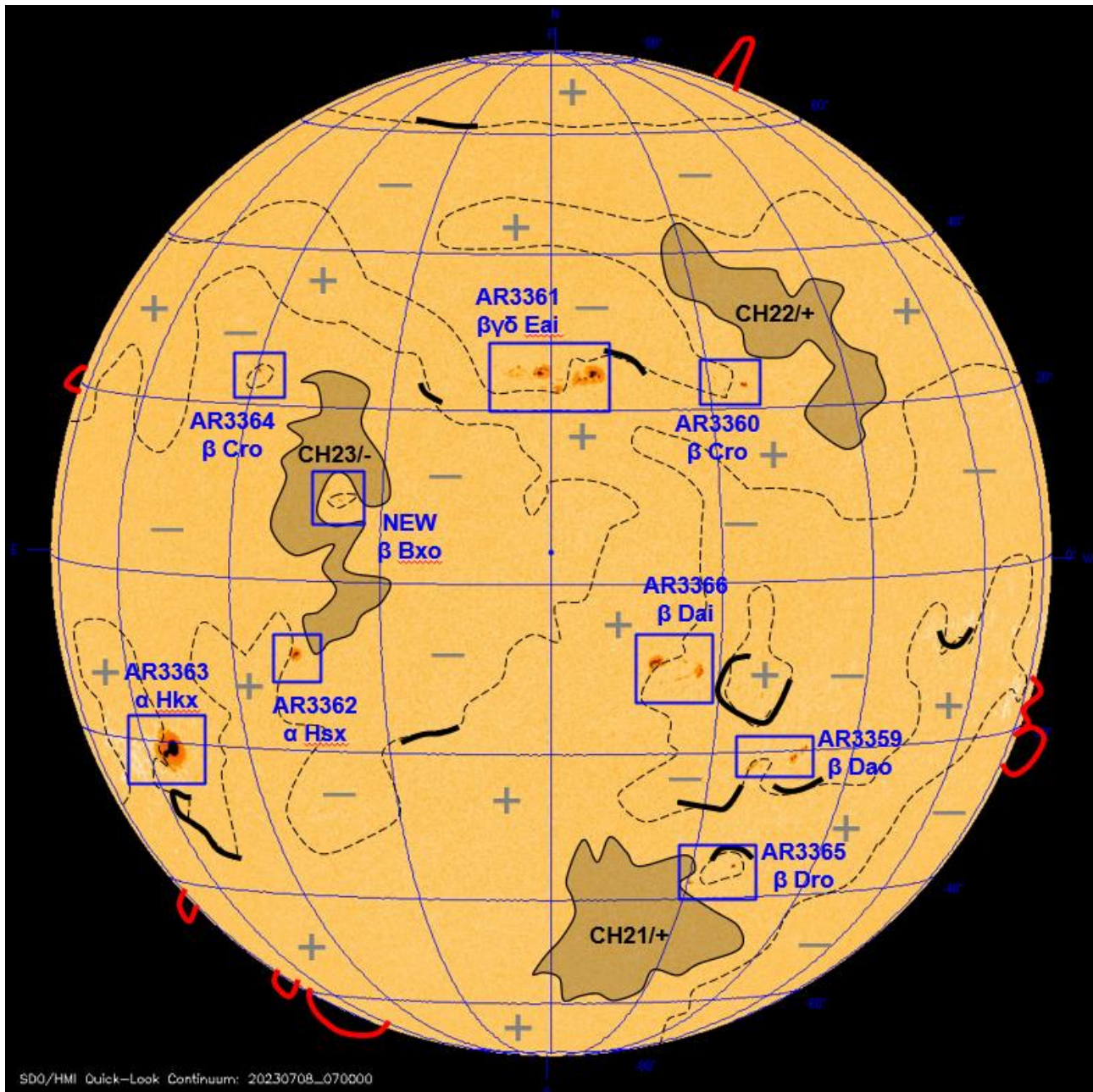
Solar Wind / Geomagnetic Activity: The CME which left the Sun on 4 July gave a glancing blow at Earth on 7 July, which has likely now passed Earth, with little further influence expected. Therefore the solar wind is expected to start at slightly elevated day 1 (08 July), before a steady decline to ambient levels in the coming days.

Geomagnetic activity is forecast to be mostly Quite to Unsettled (Kp 0-3), with a slight chance of an Active (Kp4) interval during day 1 (08 July) due to waning effecting of glancing CME and recent CH22 fast wind.

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Energetic Particles / Solar Radiation: The high energy (greater than 10MeV) proton flux has a slight but increasing chance of reaching the S1/Minor Storm threshold through the period. High energy electron flux (greater than 2MeV) is expected to remain at background to moderate levels today, then from day 2 onwards a steady increase in diurnal peaks is likely as CH/HSS influences continues to wane, probably breaching the High threshold (1000 pfu) at times. Electron fluence low at first but seeing an increasing chance of rising above the Active threshold (1e8 integrated flux) into the period.

Figure 1. Solar Analysis Valid 08/0700 UTC.



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-γ-δ and Zurich-McIntosh Axx etc.

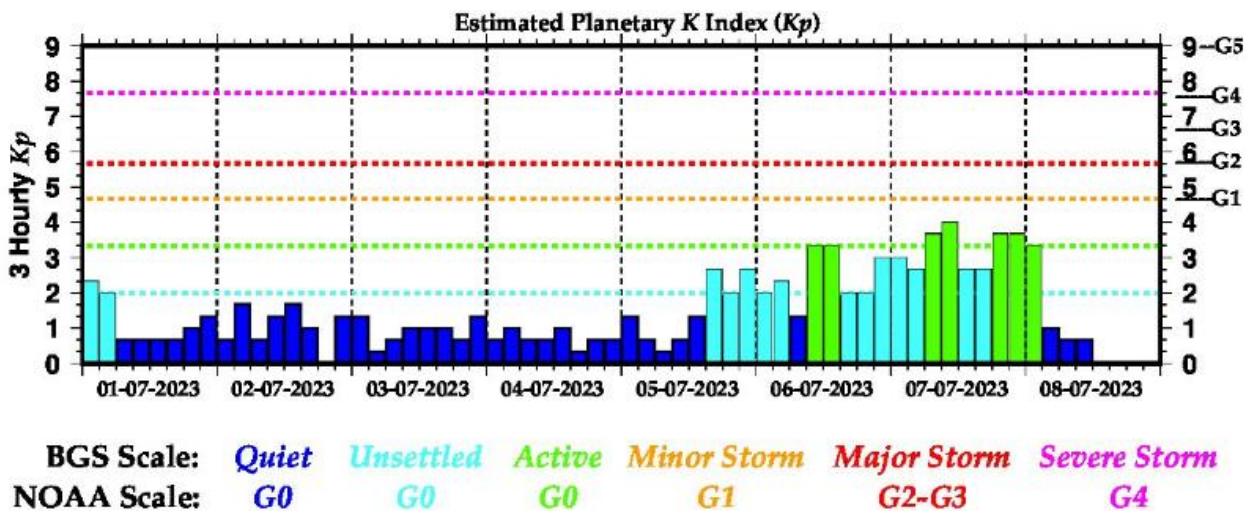
Geomagnetic Storms:

The CME which left the Sun on 4 July gave a glancing blow at Earth on 7 July, which has likely now passed Earth, with little further influence expected. Therefore the solar wind is expected to start at slightly elevated day 1 (08 July) due to continued influence from CH/22+, before a steady decline to ambient levels in the coming days.

Geomagnetic activity is forecast to be mostly Quiet to Unsettled (Kp 0-3), with a slight chance of an Active (Kp4) interval during day 1 (08 July) due to waning effects of glancing CME on July 7 and the recent fast wind from CH/22+.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: BGS Estimated Planetary K Index (Kp) – shows recent geomagnetic activity from glancing CME influence and the fast wind from CH22/+.





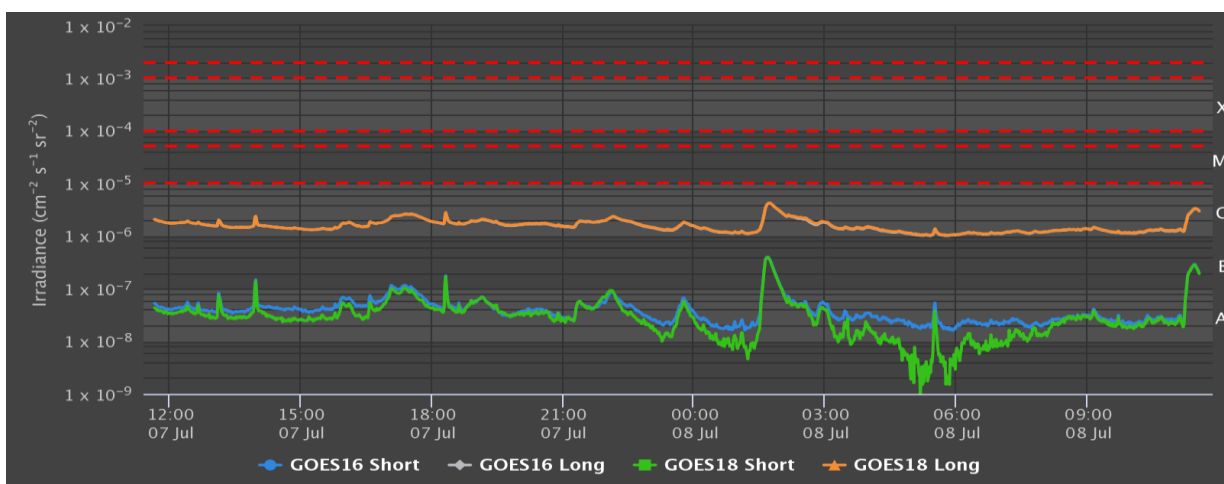
Radio Blackouts - X-Ray Flares:

Solar activity has been Low over the past 24 hours, with only minor C-class flares observed. There are currently 9 sunspot regions on the visible disc, one of which is currently unnumbered. AR3361 (Eai/Beta-Gamma-Delta) remains the most complex region, with a delta spot contained within its trailing portion. Despite its configuration it appears to be relatively stable at present. AR3366 also continues its recent development although some signs of increasing maturity in the leading and trailing spots. AR3358 in the southwest has faded to plage. A new and currently unnumbered sunspot region has emerged in the northwest quadrant, and is currently classified as a simple Bxo/Beta configuration. All other regions have shown little significant change in recent hours, appearing generally small or stable, including the large region AR3363 in the southeast quadrant, although there appears to be a large amount of plage following on behind from around the limb. This region will continue to be monitored for any further spots emerging within the area.

A continuation of generally Low to Moderate activity is expected through the period, with a slight chance of an isolated X-class flare. No major active region forecast to depart the visible disc during the period and far side sounding data suggesting further regions may rotate onto the disc into days 3 and 4 (10-11 July).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES18 X-Ray flares



Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux, as observed by GOES16, is currently at background levels. There is a slight chance of S1/Minor storm levels being reached through this period, with this risk increasing into days 3 and 4 (10-11 July) as current active regions increasingly rotate into the western hemisphere.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to remain at background to moderate levels day 1 (8 July). From day 2 onwards a steady increase in diurnal peaks is expected, perhaps breaching the High threshold (1000 pfu) at times. Electron fluence currently below the Active threshold (1e8 integrated flux), with only a slight increasing trend forecast in the Met Office REFM model, this viewed as likely too low, with an increasing chance preferred.

GEO Electron Environment	Level (cm ⁻² sr ⁻¹ day ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1x10 ⁸	No	20	40	50	60
Very Active	≥ 2 MeV ≥ 1x10 ⁹	No	1	1	1	1

Figure 4: MOSWOC REFM electron fluence – observations, forecast and recurrence

